

Goldstone Apple Valley Radio Telescope - GAVRT

DEEP SPACE NETWORK

The Goldstone Apple Valley Radio Telescope (GAVRT) Project is a partnership involving NASA, the Jet Propulsion Laboratory (JPL), the Lewis Center for Educational Research (LCER), and the Apple Valley Unified School District. This educational program uses a 34-meter antenna, recently decommissioned from NASA's Deep Space Network, for classroom radio astronomy observations via the Internet. The GAVRT Project introduces students in grades elementary through high school to the process of science with the goal of improving science literacy among American students.

What GAVRT Offers Teachers

Teachers attend a 6-day training course at LCER in California, or at a regional training center. There they learn the fundamentals of radio astronomy. The teachers receive guidelines on the use of the curriculum provided and learn how to operate the 34-meter antenna. In California, they meet the Mission Control Operators and even see the antenna up close.

Once they return to their classrooms, teachers receive ongoing support from LCER to answer questions both on curriculum issues and when they are on line gathering data.

What GAVRT Offers Students

Students remotely control the GAVRT telescope via the Internet by connecting from their classroom to the Mission Control Center at LCER who pass control of the antenna to the students.

Students learn how to gather data, what that data means, and how to analyze and record it using a computer software program. They work together, learning team participation and problem-solving skills. The results of the student data analysis are forwarded to JPL for inclusion in a database of scientific knowledge.

Students are excited by the opportunity to control the enormous antenna and teachers have noted improvements in student behavior and greater enthusiasm, not only for science but for other subjects, too.

GAVRT in the Classroom

The goal is to reach students in K-12 grades. Curriculum is currently available for students in upper elementary to high school, with lessons for the younger grades expected shortly. The educators at LCER wrote broad-based, multidiscipline curriculum guides, which teachers can implement either as they are or adapt to fit their own lesson plans.

The GAVRT curriculum can be used as a vehicle for integrated studies in elementary and middle school grades. High school science classes usually concentrate on the more complex science results and lessons featured in the guide. GAVRT is not intended as an extracurricular or gifted program.

The GAVRT curriculum meets National Science Standards and is adapted to meet individual State standards.

Curriculum Projects

The curriculum project used most widely is Jupiter Quest, where students plan a hypothetical mission to the Jovian system.



Middle School Students in Alabama.



The Deep Space Network 34-meter antenna, DSS-12, at Goldstone, California.

The GAVRT telescope is used to measure the temperature of Jupiter's atmosphere and study variations in the radio emissions from Jupiter's intense radiation belts.

EarthStar, a project requiring less classroom time commitment, involves students in studying temperature profiles of the Sun's surface correlated with optical observations of various solar phenomena.

Other curriculum projects involving galactic mapping and star formation are under development.

Data Collection and Analysis

Students use computers to record the extremely faint radio waves collected by the telescope and to analyze the data. Sometimes the data collected are plotted as a graph, and sometimes as a "map" graph. Students can manipulate the data through a software program to provide different delivery styles. For Jupiter Quest, students point the telescope at Jupiter for specified periods of time, conducting radio astronomy observations of the planet at two microwave frequencies. They analyze the data to derive the temperature in the clouds in Jupiter's atmosphere and to measure the intensity of the radiation belts that surround the giant planet. Once recorded, the data are sent to scientists at JPL who have been studying Jupiter on a continuing basis since 1972. Students in the GAVRT Program are making real contributions to the known body of scientific knowledge.

The Radio Telescope

The radio telescope is located at the Goldstone Deep Space Communications Complex in the Mojave Desert, near Barstow, California. It has a dish 34 meters (110 feet) in diameter, is nine stories high, and weighs 850,000 pounds. Known as



Teachers climbing the GAVRT antenna.

Deep Space Station 12 (DSS-12), the antenna was used by NASA's Deep Space Network to track robotic planetary missions such as the Mariner missions, Voyagers 1 and 2, Galileo, and other spacecraft exploring the Solar System.

How to Participate

There is a fee of \$975 for participation that covers the cost of training and the curriculum materials provided. Teachers are also required to pay their own travel expenses to training centers, but LCER will assist with suggestions of available education grants that can be accessed to cover this cost.

For More Information

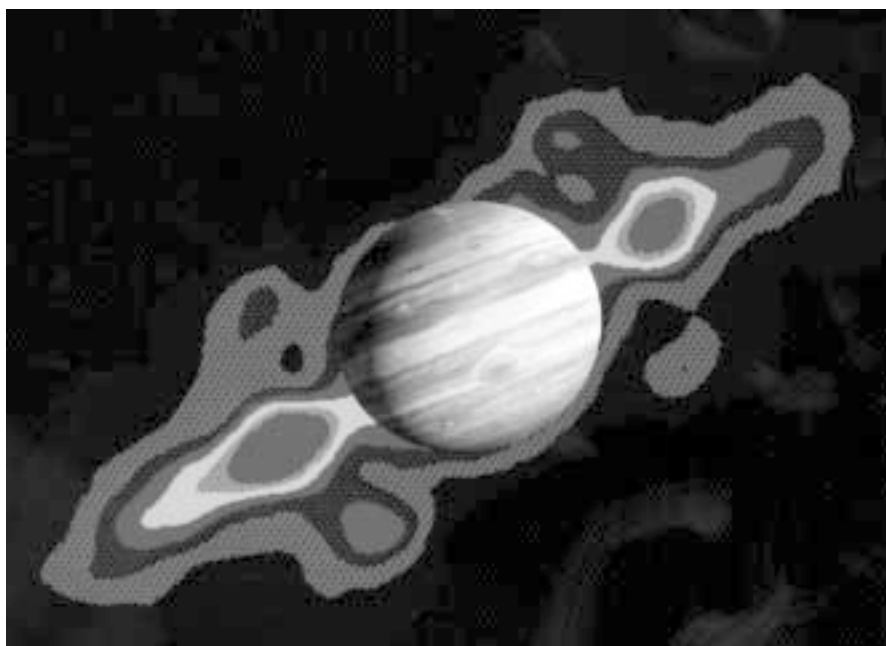
<http://deepspace.jpl.nasa.gov/dsn/applevalley>

<http://www.avstc.org/gavrt>



National Aeronautics and
Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL 400-919 10/00



An image of Jupiter as seen in visible light is superimposed over a radio brightness map of the planet's radiation belts, which are not visible through radio telescopes. (Radio brightness map is from the Very Large Array and is used with permission of the National Radio Astronomy Observatory (NRAO) and Associated Universities, Inc.)